ORIGINAL (Red)

GILBERT TANK FARM - PARCEL 463
BROWNFIELDS ASSESSMENT

Havre de Grace, MD
December 1997

Prepared by: Maryland Department of the Environment
Waste Management Administration
Environmental Restoration and Redevelopment Program
Site and Brownfields Assessments/State Superfund Division
2500 Broening Highway
Baltimore, MD 21224

Prepared for: U.S. Environmental Protection Agency
Region III
841 Chestnut Building
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GILBERT TANK FARM - PARCEL 463

AUTHORIZATION

The Maryland Department of the Environment, Waste Management Administration (MDE/WAS), performed an assessment of the Gilbert Tank Farm - Parcel 463 property as part of the Brownfields Initiative. This assessment was completed under the 1997 Cooperative Agreement between MDE and the U.S. Environmental Protection Agency (EPA).

SCOPE OF WORK

This assessment addresses environmental issues that may be a concern under the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). Data have been compiled from previous studies as well as recent interviews and sampling events. Additionally, non-CERCLA contaminant issues (petroleum products) that were discovered during this investigation have been summarized in this report and subsequently referred to MDE's Oil Control Program.

SITE DESCRIPTION

Parcel 463 is located in Havre de Grace, Harford County, Maryland. Parcel 463 is bordered on the south by Water Street and the north by the Susquehanna River. The site consists of 1.59 acres and was the site of the former Bulk Transfer Storage Plant run by Gulf Oil. All above-ground storage tanks have since been removed from the site. Current site conditions include an office building with an attached warehouse that is presently in use by Gilbert Enterprises. There is also a garage/storage building located on this parcel. Abandoned storage tanks, gasoline pumps and drums of waste oil are stored in and around this garage building. Other hazardous solvents were observed to be stored in the garage. The area where the three-million gallon storage tanks were located is swampy. A concrete retaining wall still exists around the area where three above-ground storage tanks were located. At one time, pumps and feed lines were present just north of the paved area in the middle of the property. The property is fenced.

OWNERSHIP HISTORY

Parcel 463 was purchased in September 1973 by J. Lawson Gilbert, Distributor, Inc. from the Gulf Oil Corporation. Gulf Oil purchased the property in January 1947 from Mary Alice Abbott, Joseph Abbott, and Lillian Abbott. The Abbotts had purchased the property from the Philadelphia, Baltimore and Washington Railroad Company in February 1917.

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PREVIOUS STUDIES/SITE HISTORY

Parcel 463 and Parcel 472 were both Bulk Plant Transfer Stations for Gulf Oil. MDE's Oil Control Program has records on Parcel 463 (referred to as Cluster #1) and Parcel 472 (referred to as Cluster #2). Review of the files showed that on December 1, 1972 a complaint was issued concerning an oil slick in the Susquehanna River originating from the bulk plant transfer station.

In December 1972, J. Lawson Gilbert, Distributor Inc. applied for an Oil Handler's Permit to the State of Maryland Department of Natural Resources, Water Resources Administration (DNR/WRA). On July 23, 1973, a representative from the WRA's Water Quality Permits section inspected the site. This inspection revealed that: 1) the area under the transfer pumps needed to be cleaned and a pad installed, and 2) the barge underloading drip pan needed a cover. DNR requested a compliance plan from the site on July 25, 1973. An Oil Handler's permit was issued on September 27, 1973 with an expiration date of September 27, 1978. Special conditions noted in the permit included corrective actions of problems noted in a July 25, 1973 report and the requirement to record oil level measurements prior to filling any of the tanks.

In October 1973 J. Lawson Gilbert, Distributor Inc. applied for an Oil Vehicle Operator's Certificate. The Oil Vehicle Operator's Certificate was updated in March 1975 and in January 1977.

A Field Investigations Report completed by a Water Resources Investigator on March 10, 1975 noted oil in the effluent pump. Mr. Gilbert stated that a hole in the separator was repaired but oil was still entering the final effluent sump. Subsequent field investigation reports noted no problems.

Oil Operation Permits were issued to Gilbert Enterprises (formerly J. Lawson Gilbert, Distributor, Inc.) in 1978, 1983, 1988 and 1994. One driver violation was noted in the file. A spill was reported on September 24, 1979 that involved kerosene. The 10,000-gallon spill was reportedly cleaned up.

In March 1985 Gilbert Enterprises was informed that the diked area was unacceptable as an infiltration basin. In April 1985 Gilbert informed the Oil Control Division of DNR that the abandoned tank farm area was being used as the filtration site for the separator drainage.

Reports of Observations and Oil Facility Inspection Reports from 1988 through 1991 noted unsatisfactory records and reports from the facility as well as storage of batteries, oils and solvents.

In February 1993 Gilbert Enterprises informed MDE that the bulk plant transfer station would be closed in June 1993.

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MDE SAMPLING

Site and Brownfields Assessments/State Superfund Division

On December 17, 1996 personnel from MDE's Site and Brownfields Assessment/State Superfund Division collected thirteen soil samples, four surface water samples and three sediment samples from the four parcels that comprise the Gilbert Tank Farm. Gilbert Enterprises owns all four parcels. Six soil samples (S-4 through S-9 and S-13) were collected from Parcel 463 (Figure 3). A background soil sample (S-1) was collected from public property to the east of the site.

One sediment and two surface water samples (SW-2/SED-2 and SW-4) were collected just offshore from Parcel 463. Background sediment and surface water samples (SW-1/SED-1) were collected upstream of the site.

Samples were collected to determine the potential risk to human health and the environment relevant to the future use of the property. In addition to the samples collected from the four parcels of property that comprise the Gilbert Tank Farm, a duplicate solid and aqueous sample were collected, as well as spike samples for each matrix, to fulfill the EPA Contract Laboratory Program (CLP) protocol. All samples were analyzed for the Target Compound List (TCL) and Target Analyte List (TAL) analytes (Appendix B). One field blank (FB-1) was submitted for analysis to ensure the integrity of the sample collection procedures, the cleanliness of the sample containers and the sample shipping procedures.

Soil borings were collected from the soil cuttings brought to the surface by hollow stemmed augers. All sample locations are indicated on Figure 3. Tables 1-8 summarize the contaminants detected in the samples. The laboratory analytical data from the samples collected at Parcel 463 are included as Volume II.

TARGETS

Surface Water Potential Exposure Pathway

The site is adjacent to the Susquehanna River, which enters the Chesapeake Bay approximately one mile downstream from the site.

Ground Water Potential Exposure Pathway

There are no drinking water wells located within 1/4 mile of the site.

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Soil Potential Exposure Pathway

Parcel 463 is fenced with a locked gate, minimizing access except from trespassers. The nearest residence is located approximately 100 feet from the site across Water Street. The parcel is fairly well vegetated, with some areas of asphalt covering the soil.

There is a potential for soil exposure from incidental ingestion and dust generation to on-site workers during construction or other intrusive activities.

Air Potential Exposure Pathway

The population around the site was not evaluated. The nearest residence was observed to be about 100 yards to the west of the site.

Because volatile organic compounds are not a concern at the site based on MDE's sampling, the air exposure pathway has not been identified as a concern.

MDE TOXICOLOGICAL EVALUATION

A toxicologist with MDE's Waste Management Administration evaluated the results from the MDE sampling event. Contaminant concentrations exceeding the EPA Region III Risk Based Concentrations (RBCs) were identified and evaluated. EPA Region III RBCs were developed to identify the levels at which excess noncarcinogenic and carcinogenic risk would be present for residential and industrial scenarios. The complete toxicological evaluation is included in Appendix C.

Because the future land use at this site is unknown, both residential and commercial/industrial scenarios were evaluated. For the residential scenario, the adult resident, youth resident and child resident were evaluated. For the commercial/industrial scenario, the adult worker, youth trespasser and child trespasser were evaluated.

When determining whether an increased risk to human health or the environment exists at this site, it is important to understand that this evaluation contains many extremely conservative assumptions. Because this evaluation included these conservative assumptions, a risk which exceeds EPA's recommended level of risk does not necessarily indicate an increased risk to human health. Therefore, although EPA's recommended levels of risk are slightly exceeded for incidental ingestion of iron in soil for the child resident and child trespasser, exposure to iron at this site is not expected to pose a risk to either of these populations. EPA's recommended levels of risk are not exceeded for the adult resident, youth resident, adult worker or the youth trespasser.

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While the evaluation of sediment contamination in the Susquehanna River for aquatic life was inconclusive, the surface water evaluation does not indicate increased risk to aquatic life.

RECOMMENDATIONS

Based on this information, there are no further requirements related to the investigation of hazardous waste at this site at this time. The Maryland Department of the Environment reserves its right to require additional investigation or cleanup if it determines the site poses a threat to public health or the environment or if any previously undiscovered, new or exacerbated levels of contamination are discovered.

FUTURE USE

The City of Havre de Grace is considering this property for a waterfront hotel conference center.

REFERENCES

1. MDE/Waste Management Administration, Oil Control Program records.

2. MDE/Water Management Administration, Water Supply Program, 1992.

3. USGS Topographic map, Havre de Grace, 7.5 minute, 1953, photorevised 1979.

4. Harford County Records.

GILBERT TANK FARM - PARCEL 463
TABLE 1

Volatile Organic Compounds	Soil Samples (µg/kg)						
	S-1 (background)	S-4	S-5/S-13	S-6	S-7	S-8	S-9
Methylene Chloride	11B	2B	1B/2B	5B	8B	4B	3B
Acetone	--	37B	--/7B	4B	120B	14B	6B
2-Butanone	--	--	--	--	11J	--	--
Ethylbenzene	--	--	--	--	2J	--	--

-- - not detected
B - present in quality control sample
J - estimated value
See Appendix B for list of analyzed compounds

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TABLE 2

Volatile Organic Compounds	Surface Water and Sediment Samples (µg/l in surface water, µg/kg in sediments)			
	SW-1 (background)	SW-2/SW-4	SED-1 (background)	SED-2
Methylene Chloride	--	--/--	2J	--
Acetone	--	--/--	60B	20B

-- - not detected
B - present in quality control sample
J - estimated value
See Appendix B for list of analyzed compounds

GILBERT TANK FARM - PARCEL 463
TABLE 3

Semivolatile Organic Compounds	Soil Samples (µg/kg)						
	S-1 (background)	S-4	S-5/S-13	S-6	S-7	S-8	S-9
Naphthalene	--	--	100J/--	160J	160J	--	110J
2-Methylnaphthalene	--	45J	190J/--	120J	560	--	190J
Acenaphthylene	--	--	160J/--	--	--	--	--
Acenaphthene	--	--	87J/--	300J	--	--	--
Dibenzofuran	--	--	110J/--	270J	--	--	--
Fluorene	--	--	470/51J	480J	--	--	--
Phenanthrene	71J	55J	7300/780	3900	--	--	44J
Anthracene	--	--	920/100J	890	--	--	--
Carbazole	--	--	350J/61J	430J	--	--	--
Fluoranthene	200J	--	9700/1500	4400	--	--	120J
Pyrene	190J	--	10000/1200	3800	--	--	180J
Benzo(a)anthracene	160J	--	4200/610	2300	--	--	140J
Chrysene	170J	--	4600/670	1900	--	--	140J
Bis(2-ethylhexyl)phthalate	320J	--	--/300J	--	--	--	50J

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	S-1 (background)	S-4	S-5/S-13	S-6	S-7	S-8	S-9
Benzo(b)fluoranthene	340NJ	--	5500NJ/1100NJ	2200NJ	--	--	260NJ
Benzo(k)fluoranthene	270NJ	--	5500NJ/880NJ	2200NJ	--	--	200NJ
Benzo(a)pyrene	190J	--	4000/740	1800	--	--	170J
Indeno(1,2,3-cd)pyrene	100J	--	1600/360J	780	--	--	100J
Dibenz(a,h)anthracene	45J	--	410/81J	180J	--	--	--
Benzo(g,h,i)perylene	130J	--	1600/390J	820	--	--	130J

-- - not detected
J - estimated value
N - tentative identification. Consider present.
See Appendix B for list of analyzed compounds

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TABLE 4

Semivolatile Organic Compounds	Surface Water and Sediment Samples (µg/l in surface water, µg/kg in sediments)			
	SW-1 (background)	SW-2/SW-4	SED-1 (background)	SED-2
Naphthalene	--	2J/2J	--	--
2-Methylnaphthalene	--	1J/1J	--	--
4-Nitrophenol	--	--/1J	--	--
Di-n-butylphthalate	--	1J/--	--	--
Fluoranthene	--	--/--	150J	160J
Pyrene	--	--/1J	130J	160J
Benzo(a)anthracene	--	--/--	89J	100J
Chrysene	--	--/--	88J	120J
Bis(2-ethylhexyl)phthalate	--	--/--	74J	94J
Benzo(b)fluoranthene	--	--/--	180NJ	150NJ
Benzo(k)fluoranthene	--	--/--	140NJ	150NJ
Benzo(a)pyrene	--	--/--	110J	120J

-- - not detected
J - estimated concentration level
NJ - presumed to be present at approximate concentration level
See Appendix B for list of analyzed compounds

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TABLE 5

Pesticides/PCBs	Soil Samples (µg/kg)						
	S-1 (background)	S-4	S-5/S-13	S-6	S-7	S-8	S-9
alpha-BHC	--	0.42B	--/0.10B	--	0.11B	--	--
delta-BHC	--	0.51J	2.3J/2.8J	2.1J	--	--	--
gamma-BHC	--	--	--/--	0.15J	--	--	--
Heptachlor epoxide	--	--	--/--	--	--	0.10J	--
Endosulfan I	--	--	--/0.52J	0.42J	--	--	--
Dieldrin	0.085J	--	0.32J/12J	--	--	--	--
4,4'-DDE	4.6	0.37J	--/7.5J	--	0.86J	--	1.2J
Endosulfan II	0.26J	--	2.4J/0.82J	0.19J	--	--	--
4,4'-DDD	--	0.66J	0.28J/--	4.4J	--	-	--
Endosulfan sulphate	--	--	--/--	--	0.27J	--	--
4,4'-DDT	8.4	--	19J/1.0J	0.31J	--	--	0.23J
Methoxychlor	32	20J	130J/170J	220J	--	4.4J	21J
Endrin ketone	0.13J	--	0.70J/0.94J	3.1J	--	--	0.16J
Endrin aldehyde	--	--	--/--	--	0.24J	0.18J	0.50J
alpha-Chlordane	0.33J	--	--/--	--	--	--	--
gamma-Chlordane	0.23J	--	1.5J/1.3J	0.23J	--	--	0.18J

-- - not detected
B - present in quality control sample
J - estimated concentration level
See Appendix B for list of analyzed compounds

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TABLE 6

Pesticides/PCBs	Surface Water and Sediment Samples (µg/l in surface water, µg/kg in sediments)			
	SW-1 (background)	SW-2/SW-4	SED-1 (background)	SED-2
gamma-BHC	0.0082J	--/--	--	--
Heptachlor	0.0081J	--/--	--	--
Aldrin	0.0092J	--/--	--	--
Dieldrin	0.020B	--/--	0.32J	0.81J
4,4'-DDE	--	--/--	1.2J	1.6J
Endrin	0.017J	--/--	0.53J	--
Endosulfan II	--	--/--	--	0.87J
4,4'-DDT	0.022B	--/--	1.3J	--
Methoxychlor	--	--/--	--	20J
Endrin ketone	--	--/--	0.28J	--
Endrin aldehyde	--	--/--	0.56J	--

-- - not detected
J - estimated concentration level
See Appendix B for list of analyzed compounds

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TABLE 7

Inorganics	Soil Samples (mg/kg)						
	S-1 (background)	S-4	S-5/S-13	S-6	S-7	S-8	S-9
Aluminum	8870	11500	16100/11400	5840	3080	8060	5670
Antimony	--	--	--/0.63B	38.3L	--	--	--
Arsenic	4.0	2.7	5.0/5.6	15.7	3.0	5.5	5.8
Barium	161	38.2	58.5/271	457	32.9	36.8	119
Beryllium	0.65	0.34	0.46/0.55B	0.37	0.13	0.50	0.38
Cadmium	0.64	0.37	0.73/2.0	6.9	0.24	0.45	0.74
Calcium	2730J	352J	283J/729J	4200J	--	961J	2360J
Chromium	19.0	17.1	21.3/22.3	39.6	23.9	14.6	38.1
Cobalt	7.5	4.3	6.8/7.2	13.3	1.3	7.9	6.0
Copper	24.8	8.3	19.9/31.2	166	20.1	13.4	27.1
Cyanide	0.25B	0.09B	0.20B/1.2	1.5	0.08B	0.11B	1.1
Iron	15200	18300	26400/21300	118000	11700	20200	16900
Lead	56.0	12.3	61.9/259	13300	72.1	13.4	1230
Magnesium	1850	1390	1430/1480	1130	180	2020	1210
Manganese	348	96.6	244/248	1870	32.4	256	103
Mercury	--	--	--/0.5	0.50	--	--	0.07L
Nickel	10.5	7.6	10.0/16.8	62.9	4.2	12.3	12.0
Potassium	638J	614J	898J/743J	549J	160J	956J	534J
Selenium	--	--	--/--	--	--	--	0.88L
Silver	1.2	1.3	1.9/1.9	9.3	0.98	1.7	1.0
Sodium	105	78.4	109/80.6	384	41.0	109	110
Thallium	0.57	0.58	0.60/0.62	0.72	0.55	0.61	0.61
Vanadium	25.2	29.1	37.5/31.1	17.3	12.1	18.5	17.5
Zinc	75.1	25.7B	58.7/196	1930	31.1	50.0	188

-- - not detected
B - present in quality control sample
J - estimated concentration level
L - biased low. Actual concentration expected to be higher.
See Appendix B for list of analytes

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TABLE 8

Inorganics	Surface Water and Sediment Samples (ug/l in surface water, mg/kg in sediments)			
	SW-1 (background)	SW-2/SW-4	SED-1 (background)	SED-2
Aluminum	1430	1340/1350	12100	11800
Arsenic	2.1	2.1/2.1	2.6K	6.6K
Barium	37.0	35.8/36.1	107	113
Beryllium	0.60	0.6/0.6	1.1	1.7
Cadmium	1.1	1.1/1.1	0.64	1.3
Calcium	138J	13700J/13600J	1560J	2760J
Chromium	3.4B	2.7B/2.7B	21.1	20.8
Cobalt	1.9	1.7/2.0	19.6	43.2
Copper	5.3B	5.3B/7.4B	19.7	34.7
Cyanide	1.8B	2.2B/15.0	1.8	0.21B
Iron	1970L	1890L/1870L	22000	26100
Lead	3.6B	6.1B/7.5B	19.3	39.9
Magnesium	4400	4350/4340	3330	3170
Manganese	143	135/134	851	1730
Nickel	5.8	4.7/5.2	32.2	60.7
Potassium	2140J	2120J/2130J	1270J	1340J
Silver	1.4	1.4/1.4	1.8	2.7
Sodium	5270	5120/5240	116	160
Thallium	2.5	2.5/2.5	1.0	1.2
Vanadium	2.4	2.3/2.4	23.6	20.3
Zinc	45.9B	42.2B/47.3B	107	238

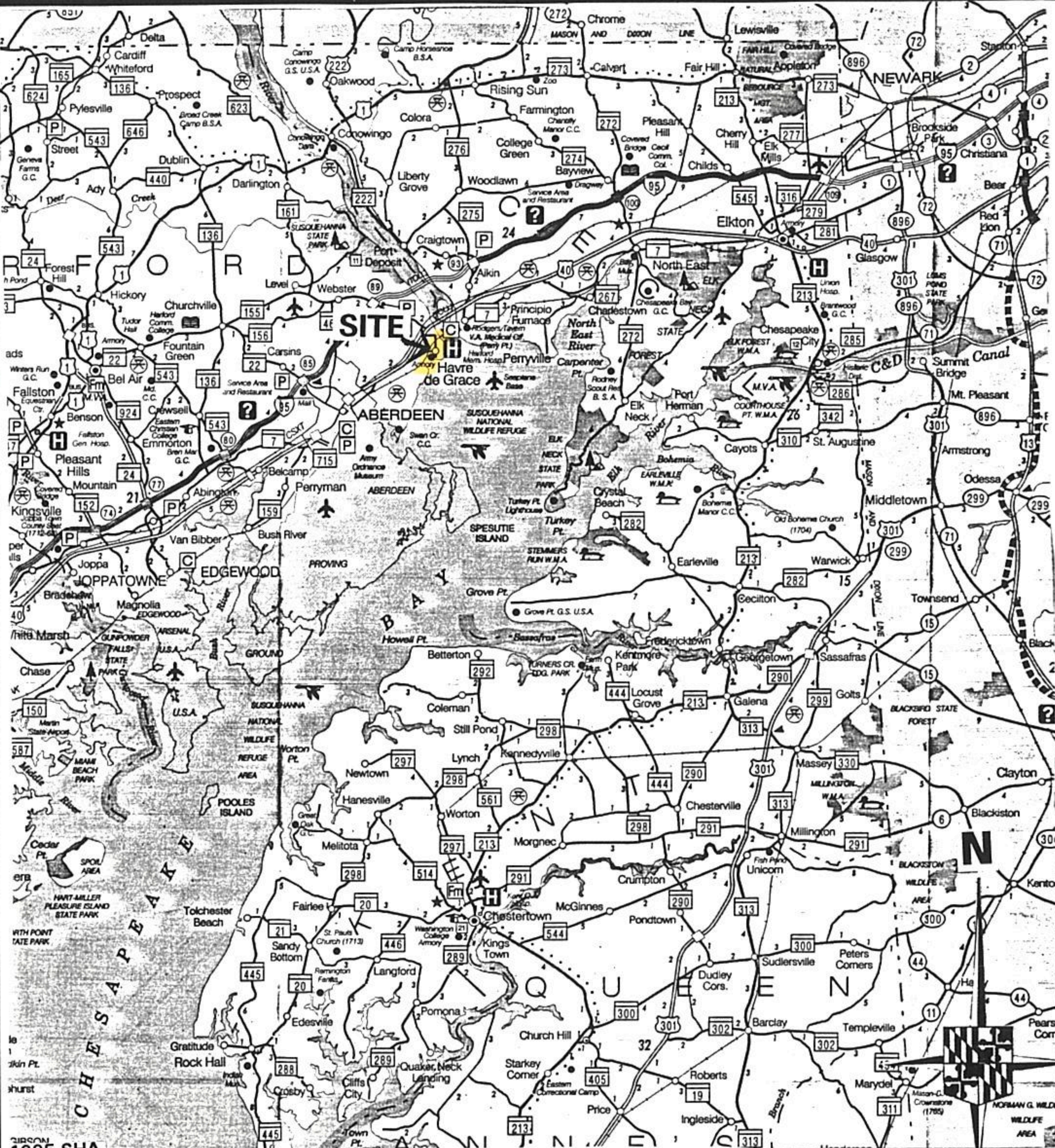
B - present in quality control sample
J - estimated concentration level
K - biased high. Actual concentration expected to be lower.
L - biased low. Actual concentration expected to be higher.
See Appendix B for list of analytes

ORIGINAL (Red)

APPENDIX A - FIGURES

REGIONAL HIGHWAY MAP

FIGURE 1



SCALE

0 6 12 MILES

0 10 20 KILOMETERS

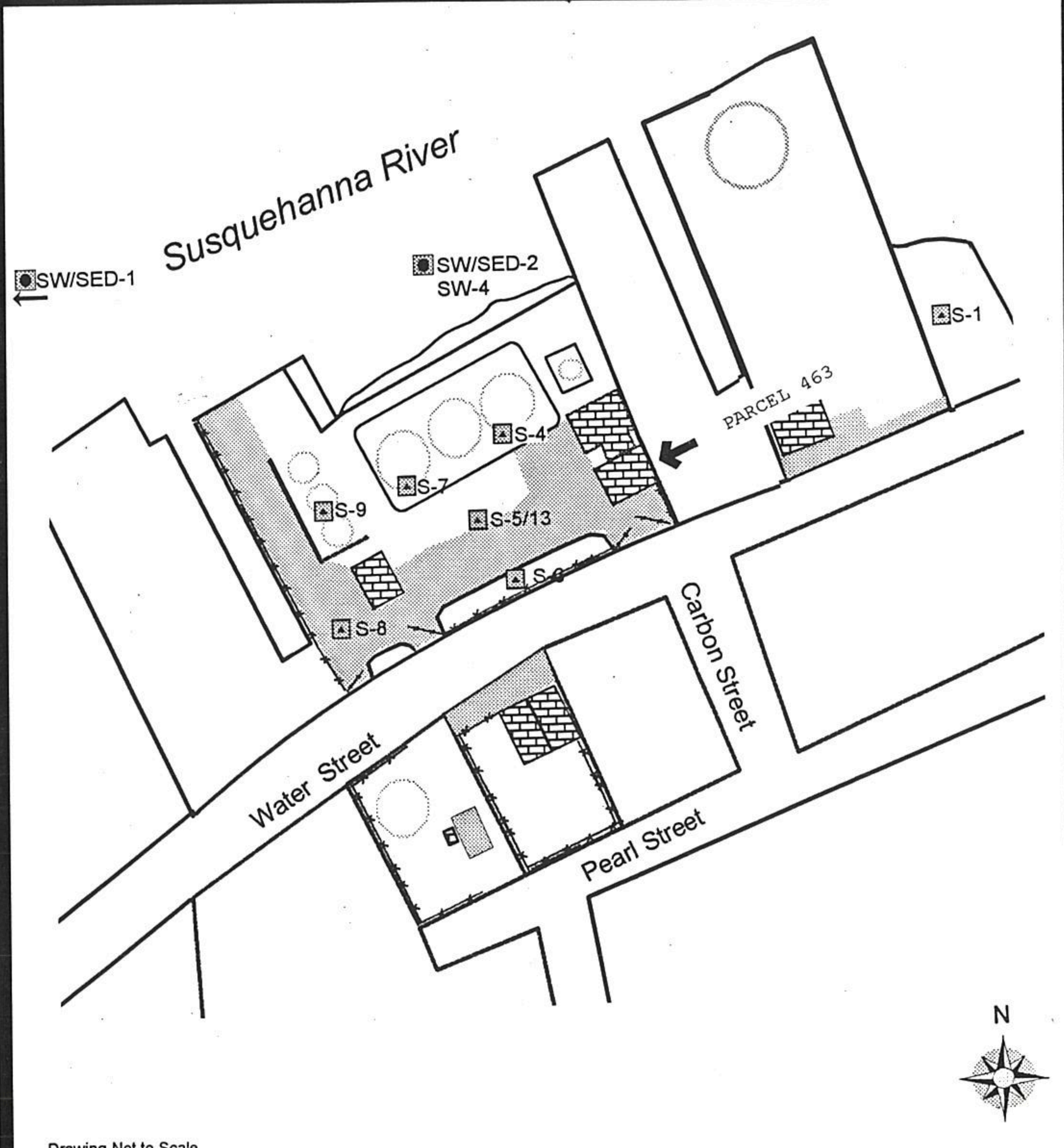
1:380,160

STREET MAP

FIGURE 2

SITE MAP

FIGURE 3



Building/Structure

Soil Sample Location

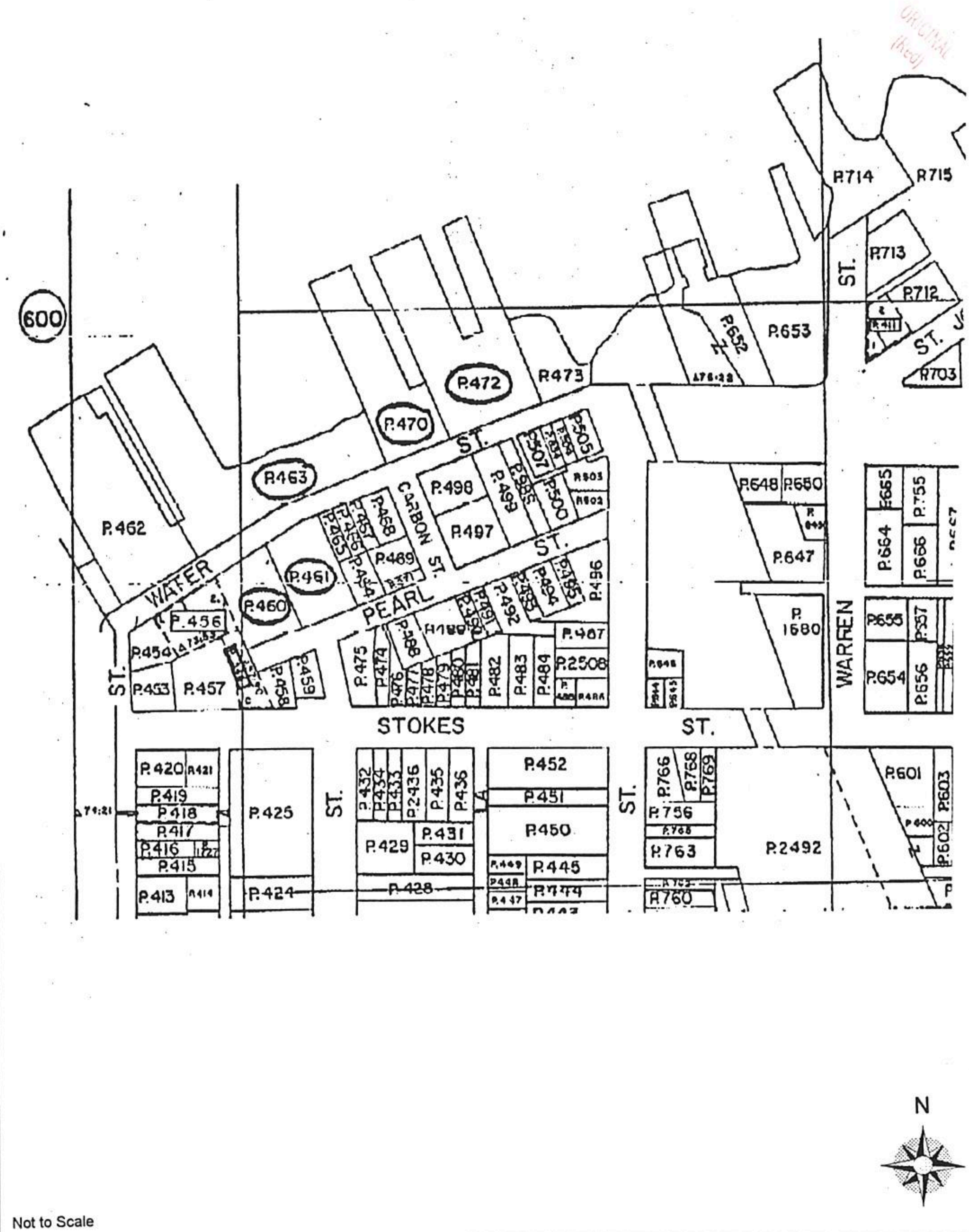
Surface Water/Sediment Sample Location

Former Location of Above-ground Tanks

Paved Area

PARCEL MAP

Figure 4



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APPENDIX B - TARGET ANALYTE LIST/TARGET COMPOUND LIST

TARGET COMPOUND LIST

VOLATILES

Acetone
Benzene
Bromodichloromethane
Bromoform
Bromomethane
2-Butanone
Carbon Disulfide
Carbon Tetrachloride
Chlorodibromomethane
Chlorobenzene
Chloroethane
Chloroform
Chloromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
trans-1,2-Dichloroethene
1,2-Dichloropropane
cis-1,2-Dichloropropene
trans-1,3-Dichloropropene
Ethylbenzene
2-Hexanone
Methylene Chloride
4-Methyl-2-Pentanone
Styrene
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Toluene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Vinyl acetate
Vinyl chloride
Xylene (total)

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SEMIVOLATILES

Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Benzo(k)flouranthene
Benzoic Acid
Benzyl alcohol
Bis(2-chloroethyl)ether
Bis(2-chloroethoxy)methane
Bis(2-chloroisopropyl)ether
Bis(2-Ethylhexyl)phthalate
4-Bromophenyl phenyl ether
Butylbenzylphthalate
4-Chloroaniline
4-Chloro-3-methylphenol
2-Chloronaphthalene
2-Chlorophenol
4-Chlorophenyl phenyl ether
Chrysene
Dibenzo(a,h)anthracene
Dibenzofuran
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
3-3'-Dichlorobenzidine
2,4-Dichlorophenol
Diethyl phthalate
2,4-Dimethylphenol
Di-n-butylphthalate
4,6-Dinitro-2-methylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Dimethylphthalate
Di-n-octylphthalate
Fluoranthene
Fluorene
Hexachlorobenzene

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Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachlorethane
Indeno(1,2,3-cd)pyrene
Isophorone
2-Methylnaphthalene
2-Methylphenol
4-Methylphenol
Naphthalene
2-Nitroaniline
3-Nitroaniline
4-Nitroaniline
Nitrobenzene
2-Nitrophenol
4-Nitrophenol
N-Nitrosodiphenylamine
N-Nitroso-di-n-propylamine
Pentachlorophenol
Phenanthrene
Phenol
Pyrene
1,2,4-Trichlorobenzene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol

PESTICIDES AND PCBS

Aldrin
alpha-BHC
beta-BHC
gamma-BHC (Lindane)
delta-BHC
alpha-Chlordane
gamma-Chlordane
4,4-DDT
4,4-DDE
4,4-DDD
Dieldrin
Endosulfan
Endosulfan II
Endosulfan sulfate
Endrin
Endrin ketone
Heptachlor
Heptachlor epoxide
Methoxychlor
PCB-1016
PCB-1221
PCB-1232
PCB-1242
PCB-1248
PCB-1254
PCB-1260
Toxaphene

TARGET ANALYTE LIST

(INORGANICS)

Aluminum
Antimony
Arsenic
Barium
Beryllium
Cadmium
Calcium
Chromium
Cobalt
Copper
Cyanide
Iron
Lead
Magnesium
Manganese
Mercury
Nickel
Potassium
Selenium
Silver
Thallium
Sodium
Vanadium
Zinc

APPENDIX C - TOXICOLOGICAL EVALUATION

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10/14/97

Gilbert Tank Farm/Parcel 463

Toxicological Evaluation

Summary

Risk at the Gilbert Tank Farm/Parcel 463 site was evaluated for child (1 - 6 years), youth (6 - 17 years), and adult residents under residential scenarios, for adult workers under commercial/industrial scenarios, and for youth (6 - 17 years) and child (1 - 6 years) trespassers under trespassing scenarios. USEPA recommended default exposure parameters were used to estimate cumulative risk from all chemicals in each scenario (1, 2, 3). The United States Environmental Protection Agency (USEPA) recognizes as an acceptable Hazard Index (HI) values less than or equal to 1 and excess lifetime cancer risk (CR) less than or equal to 10^{-4} - 10^{-6}. Based on these exposures, estimated risks at the site were compared to USEPA recommended levels, and the following conclusions were reached:

USEPA's recommended noncarcinogenic risk for the child (1 - 6 years) resident and the child (1 - 6 years) trespasser are exceeded (HI > 1) through incidental ingestion of soil. For both populations, iron is the risk driver.

Although USEPA recommended levels of risk are exceeded by these populations, exposure to contaminants at this site is not expected to pose a threat to public health for either residential or commercial/industrial populations.

While the evaluation of sediment contaminant levels for risk to aquatic life was inconclusive, the surface water evaluation does not indicate increased risk to aquatic life.

1.0 Site Description

The Gilbert Tank Farm site is located in Havre de Grace, Maryland. For this Brownfields investigation, the site was divided into 4 parcels, identified as Parcels 460, 461, 463, and 472. This toxicological evaluation is for Parcel 463, which is a lot approximately 1.59 acres adjacent to the Susquehanna River. The property is fenced, although the fence may not be a permanent restriction. This area of the Susquehanna River is designated Use I-P in the Code of Maryland Regulations (COMAR) and is protected for public water supply, water contact recreation, and aquatic life (4). Public water supply intakes are located within upstream of the site. Two soil samples were collected at Parcel 463. These samples were collected from 8 - 14 inches to a depth of 5 feet, with one sample collected at an unrecorded depth. Following the direction of the project manager, contaminant concentrations in the surface soil is assumed to be consistent with those detected throughout the soil. Therefore, this evaluation will assume all populations will be exposed to contaminants at concentrations similar to those detected in the samples collected.

One surface water sample was collected coincident with a sediment sample from the Susquehanna River, just offshore of the site. A duplicate surface water sample was collected from this location. Background samples were collected for soil, surface water, and sediment.

2.0 Method

In evaluating risk to human health and the environment, maximum concentrations of all chemicals detected in soil, surface water, and sediment were compared to medium-specific screening levels. Chemicals which exceeded human health screening levels were then evaluated quantitatively. Any chemical which exceeded an ecological screening level and was present at a concentration above background was then evaluated more comprehensively.

2.1 Human Health

Maximum detected concentrations of all chemicals detected in soils (dry weight values) were compared to the USEPA Region III Risk Based Concentrations (RBC) for residential soils (5). Comparison of dry weight analytical values to the RBCs is recognized as a conservative measure but provides consistency in risk assessments across sites (with variable soil moisture content) and sampling time. Prior to comparison with each chemical concentration, noncarcinogenic RBCs were multiplied by 0.1, in order to account for any additivity of systemic effects. Any contaminant which exceeded its respective RBC was then evaluated quantitatively. This quantitative evaluation is based on expected future use and development scenarios and includes populations typically expected to frequent the site based on this proposed future use.

At this location, the Susquehanna River is designated as a potable water supply, and surface water is assumed to be utilized as a public water source. The maximum detected contaminant concentrations in surface water samples collected from the Susquehanna River were compared to Maryland's water quality standards for the protection of human health through drinking water (4) or, for those substances for which Maryland has not yet developed standards, USEPA's recommended ambient water quality criteria (AWQC) for human health through drinking water (6). Additionally, the maximum concentration of each chemical identified in the surface water was compared to RBC levels for tap water (5). Contaminants detected in surface water which exceeded their respective RBCs were included in the quantitative evaluation.

As no sediment RBCs have been developed, maximum detected concentrations for each contaminant identified in sediment samples were compared to residential RBCs for soil (5). These levels are a conservative screen since frequent exposure to sediment is much less likely than for soils. Any contaminant which exceeded its respective RBC was then evaluated quantitatively.

The future land use at the Gilbert Tank Farm site is unknown. Therefore, both residential and commercial/industrial scenarios were used to evaluate risk at Parcel 463. The Susquehanna River is a potable water supply, and populations are assumed to be using this water as their drinking water source. The contaminants identified at the site at concentrations which exceeded RBCs were evaluated with regard to risk to relevant populations under the following scenarios (1, 2, 3):

Residential Development:

Adult Resident: 70 kg body weight, 350 days per year exposure for soil and surface water ingestion, 100 mg soil ingested per day, 2 liters of surface water ingested per day, 52 days per year exposure for sediment ingestion (2 days per week for 26 weeks), 50 mg sediment ingested per day, 30 year exposure duration, 70 year lifetime.

Youth Resident (6 - 17 years): 40 kg body weight, 350 days per year exposure for soil and surface water ingestion, 100 mg soil ingested per day, 2 liters of surface water ingested per day, 78 days per year exposure for sediment ingestion (3 days per week for 26 weeks), 50 mg sediment ingested per day, 12 year exposure duration, 70 year lifetime.

Child Resident (1 - 6 years): 16 kg body weight, 350 days per year exposure for soil and surface water ingestion, 200 mg soil ingested per day, 1 liter of surface water ingested per day, 78 days per year exposure for sediment ingestion (3 days per week for 26 weeks), 100 mg sediment ingested per day, 6 year exposure duration, 70 year lifetime.

Commercial/Industrial Development:

Adult Worker: 70 kg body weight, 250 days per year exposure for soil and surface water ingestion, 50 mg soil ingested per day, 1 liter of surface water ingested per day, 52 days per year exposure for sediment ingestion (2 days per week for 26 weeks), 50 mg sediment ingested per day, 25 year exposure duration, 70 year lifetime.

Youth Trespasser (6 - 17 years): 40 kg body weight, 132 days per year exposure for soil ingesion (5 days per week during 12 summer weeks and 3 days per week during 24 spring and fall weeks), 100 mg soil ingested per day, 78 days per year exposure for sediment ingestion (3 days per week for 26 weeks), 50 mg sediment ingested per day, 12 year exposure duration, 70 year lifetime.

Child Trespasser (1 - 6 years): 16 kg body weight, 132 days per year exposure for soil ingestion (5 days per week during 12 summer weeks and 3 days per week during 24 spring and fall weeks), 200 mg soil ingested per day, 78 days per year exposure for sediment ingestion (3 days per week for 26 weeks), 100 mg sediment ingested per day, 6 year exposure duration, 70 year lifetime.

The youth trespasser and the child trespasser are not assumed to ingest surface water while trespassing on the site, although incidental ingestion of surface water during recreational activities might occur. Exposure during recreational activities includes both incidental ingestion of surface water and sediment, and the estimation of risk through incidental ingestion of sediment during recreational activities contributes to the cumulative risk more significantly. Therefore, the risk from incidental ingestion of surface water is negligible by comparison, and is not quantitatively estimated in this assessment.

2.2 Ecological

In the evaluation of potential ecological risk, future use of the site was considered. Since the future use is not known, these plans include residential or commercial/industrial development, and both people and wildlife are likely to be exposed. The risk through exposure to soil assessed for human health may be considered protective of any wildlife which may frequent the site.

Maximum contaminant concentrations detected in the surface water samples were compared to Maryland's water quality standards for the protection of aquatic life from acute and chronic effects (4). For those substances for which Maryland has no numeric water quality standards, USEPA's recommended ambient aquatic life criteria were utilized (6).

Sediment screening levels for ecological risk are less readily available than surface water screening levels. Therefore, the maximum detected concentration in sediments was first compared to the background sample to determine if the samples adjacent to the site exceeded background levels, then the site concentration was compared to USEPA's draft sediment quality criteria (which assume 1% organic carbon) (7). For those substances for which USEPA has not drafted sediment quality criteria (SQC), sediment quality benchmarks (SQB), developed in a manner consistent with that of the draft sediment quality criteria and assuming 1% organic carbon content of sediments, were utilized (7). Sediment quality benchmarks were derived for screening for those chemicals for which EPA has not published SQBs. For substances for which neither of these screening values are available, the Effects Range-Median (ER-M) values developed by the National Oceanic and Atmospheric Administration (NOAA) were used (8). These values represent sediment concentrations which, in half the sediment samples evaluated, were associated with sediment toxicity.

3.0 Human Health Evaluation

3.1 Soil

The chemicals detected in site soils which exceeded RBCs are aluminum, antimony, arsenic, beryllium, cadmium, chromium, iron, manganese, and several polycyclic aromatic hydrocarbons (PAHs), including benzo[a]pyrene. These contaminants are included in the quantitative evaluation.

Not all PAHs were detected at concentrations which exceeded RBCs. There are over 100 PAHs, but benzo[a]pyrene is by far the most researched because of the early recognition of its carcinogenicity. Therefore, since benzo[a]pyrene exceeds its RBC (5), maximum concentrations of all detected PAHs, including those for which no RBCs are available (acenaphthylene, benzo[g,h,i]perylene, 2-methylnaphthalene, and phenanthrene) are included in the quantitative assessment.

No RBC is available for lead. USEPA has issued a directive which recommends a screening level of 400 ppm for residential scenarios at RCRA facilities and CERCLA sites, which is used in this evaluation (9). The maximum concentration of lead detected in soils at Parcel 463 does exceed this screening value, and lead is included in the evaluation.

Magnesium, calcium, potassium, and sodium are essential nutrients toxic only at very high concentrations and are found naturally in soils. No RBC levels exist for these chemicals, and they are not included in the quantitative risk estimate.

The background soil sample was found to contain several chemicals at concentrations in excess of RBC levels (5). These chemicals are aluminum, arsenic, beryllium, iron, manganese, and several PAHs, including benzo[a]pyrene. Risk through exposure to chemicals found in the background soil sample was also evaluated.

The quantitative estimate of risk through incidental soil ingestion included arsenic and beryllium evaluated for carcinogenic and noncarcinogenic risks (Tables 1, 2, 6, and 7) (5). Aluminum, antimony, cadmium, chromium, iron, and manganese were evaluated only for noncarcinogenic risks (Tables 1 and 6); they are not considered carcinogens (5). Reference dose (RfD) and cancer potency (q_1*) values were obtained from USEPA Region III and IRIS (5, 10).

Lead was detected in each of the 7 soil samples collected onsite, with the background sample containing 56.0 mg/kg. Concentrations for 5 of these 7 samples range from 12.3 mg/kg to 259 mg/kg. The remaining 2 samples contained lead identified at concentrations of 1230 mg/kg (Soil-9) and 13300 mg/kg (Soil-6), both of which exceed the USEPA screening level of 400 mg/kg for lead in soil for residential scenarios at CERCLA and RCRA sites (9).

Lead is a naturally occurring inorganic element that is frequently found in small amounts in nature. Signs and symptoms of lead toxicity depend on lead concentration in the tissue and the age of the individual. Chronic exposure to low levels of lead can interfere with the blood forming and reproductive systems, kidney function and metabolism, and produce subtle effects on personality, memory, learning, reaction time, psychomotor function, and motor coordination. Infants and young children are very sensitive to the toxic effects of lead on the nervous system. Impaired neurological development has been observed in children exposed to relatively low concentrations of lead. At higher concentrations, lead is toxic to the central nervous system and can produce neurological motor dysfunction. There is no oral RfD for inorganic lead (10). Therefore, a quantitative noncarcinogenic assessment was not performed. Additionally, lead is classified as a group B2 (probable human) carcinogen by USEPA (10), although USEPA has not derived a cancer potency value. Although not quantitatively assessed, frequent ingestion of soil at this location may have the potential to cause adverse health effects.

PAHs are a group of chemically similar compounds that are found naturally or as a result of human activity. Noncarcinogenic risk was evaluated for all PAHs detected at the site for which RfDs are available or which are structurally similar to those for which RfDs are available (Tables 1 and 6). RfDs are not available for the four PAHs detected at the site for which no RBCs are available. These chemicals were then compared on a structural basis, in order to identify an appropriate RfD value for the quantitative assessment. For acenaphthylene, phenanthrene, and benzo[g,h,i]perylene, pyrene was used, and for 2-methylnaphthalene, the RfD for naphthalene was used (12, 13).

Many PAHs have been shown to exhibit carcinogenic potential in studies with laboratory animals following oral absorption. Of these, the most studied is benzo[a]pyrene, which is considered a group B2 (probable human) carcinogen and for which specific toxicity information, including a cancer slope factor, q_1*, exists (12, 13). PAHs considered to be carcinogenic and for which USEPA has not yet derived q_1* values, were evaluated using their relative potency values (relative to benzo[a]pyrene) to adjust their maximum concentrations to "relative" concentrations (13), as shown in Table 16. A q_1* value is available for the PAH carbazole; therefore, the carbazole q_1*, which is independent of the q_1* for benzo[a]pyrene, was used in the quantitative cancer risk calculations shown in Tables 2 and 7. Presently, there are no regulatory levels to assess the systemic risk associated with exposure to carcinogenic PAHs; noncarcinogenic risk is not evaluated for these PAHs. Human health risk due to exposure to these PAHs is therefore assessed based on potential carcinogenicity, and is presented in Tables 2 and 7.

3.2 Surface Water

No contaminants identified in the surface water exceeded Maryland water quality standards or USEPA ambient water quality criteria for the protection of human health (4, 6). Contaminants identified in surface water which exceeded RBC screening values are iron and manganese (5).

The background surface water sample was found to contain chemicals in excess of RBC levels (5). These chemicals are iron and manganese. Risk through exposure to chemicals found in the background surface water sample was also evaluated.

Evaluation of risk from exposure to contaminants in surface water included iron and manganese for noncarcinogenic risks (Tables 3 and 8) (5). RfD and q_1* values were obtained from USEPA Region III and IRIS (5, 10).

3.3 Sediment

Chemicals identified in the sediment which exceeded RBC screening values are aluminum, arsenic, beryllium, iron, manganese, and several PAHs, including benzo[a]pyrene, and they are included in the quantitative assessment (5).

The background sediment sample was found to contain several chemicals in excess of RBC levels (5). These chemicals are aluminum, arsenic, beryllium, iron, manganese, and several PAHs. Risk through exposure to chemicals found in the background sediment sample was also evaluated.

Of the contaminants identified in sediment, aluminum, iron, and manganese were evaluated for noncarcinogenic risks (Tables 4 and 9) (5). Arsenic and beryllium were evaluated for both noncarcinogenic and carcinogenic risks (Tables 4, 5, 9, and 10) (5). PAHs were evaluated for both carcinogenic and noncarcinogenic risks, following the format for PAHs outlined previously (Tables 4, 5, 9, and 10). PAHs considered to be carcinogenic and for which USEPA has not yet derived q_1* values, were evaluated using their relative potency values (relative to benzo[a]pyrene) to adjust their maximum concentration to "relative" concentrations (13), as shown in Table 17. RfD and q_1* values were obtained from USEPA Region III and IRIS (5, 10)

4.0 Ecological Evaluation

4.1 Surface Water

Surface water contaminants were compared to Maryland ambient water quality standards and federal water quality criteria. The maximum detected concentration of total cyanide, 15 ug/l at SW-4, exceeded Maryland's chronic standard for freshwater aquatic life of 5.2 ug/l free cyanide (4). Sample SW-4 is a duplicate of Sample SW-2, and the total cyanide concentration detected at SW-2 is 2.2 ug/l, a concentration similar to that concentration detected in the blank. It is important to note that site data represent total cyanide, while Maryland's standard is based on free cyanide. Aluminum and iron were detected at maximum concentrations of 1350 ug/l and 1890 ug/l, respectively, which are similar to background concentration of 1430 ug/l for aluminum and 1970 ug/l for iron. These concentrations exceed USEPA chronic water quality criteria for the protection of freshwater aquatic life, 87 ug/l for aluminum and 1000 ug/l for iron, which, as with Maryland's standards, are based on dissolved metals while the site data reflect total metals (6). Additionally, the freshwater iron criterion is based on a 1976 qualitative study which Maryland finds technically insufficient. Maryland standards or USEPA criteria are not available for barium, cobalt, manganese, and vanadium; however, these chemicals were detected at concentrations similar to background levels. No standards or criteria are available for calcium, magnesium, potassium, and sodium, which are natural constituents of water.

4.2 Sediment

In the evaluation of contaminants identified in sediment, nickel was detected at a concentration of 60.7 mg/kg, which slightly exceeds the NOAA ER-M value of 51.6 mg/kg. Additionally, nickel is present in the site sediments at a concentration which exceeds background levels of 32.2 mg/kg (8). It is important to note that NOAA ER-M values were derived using marine and estuarine sediments, which may differ from freshwater sediments in bioavailability of metals and sensitivity of resident organisms. Also, the ER-M value for nickel is considered to be technically insufficient by the author (8). Calcium, sodium, potassium, and magnesium, which are natural constituents of sediment, do not have screening criteria and are unlikely to pose significant ecological risk. No screening values are available for aluminum, barium, beryllium, cobalt, copper, iron, manganese, and vanadium, and all except aluminum and vanadium were present at concentrations which exceeded background levels.

5.0 Conclusion

5.1 Human Health

The estimated risk for the adult and youth (6 - 17 years) resident (Table 1) and the adult worker and youth (6 - 17 years) trespasser (Table 6) from incidental ingestion of soil falls at or below the noncarcinogenic risk recommended by USEPA, while the estimated risk for the child (1 - 6 years) resident and child (1 - 6 years) trespasser from incidental ingestion of soil exceeds this value (Table 1). A closer evaluation of the estimated risk shows that iron is a risk driver to both child. A risk driver is a chemical which, by itself, exceeds the USEPA's recommended levels of risk. All populations considered to be exposed through incidental ingestion of soil fall within the acceptable CR (Tables 2 and 7).

Risk estimated from ingestion of surface water resulted in HI values for all 3 residential populations (Table 3) and the adult worker population (Table 8) falls below the level recommended by USEPA. No CR values were calculated, as the contaminants at the site are not recognized as carcinogenic.

The calculated noncarcinogenic and carcinogenic risks from incidental exposure to sediment fall within or below USEPA recommended levels (Tables 4, 5, 9, and 10).

Calculated noncarcinogenic and carcinogenic risk from exposure to the background falls below USEPA recommended levels for all populations (Tables 11, 12, 13, 14, and 15).

In summary, the noncarcinogenic risk estimated for child (1 - 6) residents and child (1 - 6 years) trespassers exceeds USEPA recommended levels for incidental ingestion of soil. Iron is the risk driver (Table 20).

When determining whether an increased risk to human health exists at this site, it is important to understand that this evaluation was prepared as a first level screening evaluation. Many conservative assumptions are included in this evaluation, which was developed with the understanding that if the estimated risk, with the conservative assumptions, does not exceed USEPA's recommended levels, then the risk estimated using more realistic scenarios will not

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exceed these levels.

However, because this evaluation includes many conservative assumptions, a risk which exceeds USEPA's recommended level of risk does not necessarily indicate an increased risk to human health. When this situation occurs, it is necessary to consider several points when determining if the risk actually does represent a threat to human health. For example, the quantitative risk estimate in this evaluation assumes people will be exposed to a contaminant at the maximum concentration all throughout the site and for the entire exposure duration, which does not take into account whether the maximum concentration is anomalous or characteristic of the site, or biodegradation, dispersion, dilution, or other factors which may decrease the contaminant concentration throughout the time of exposure. The risk estimate also includes many conservative exposure assumptions regarding exposure frequency and duration, as outlined in Section 2.1.

This evaluation also assumes that the bioavailability of each contaminant is 100%, and that all of the contaminant taken into the body is absorbed across the digestive tract into the body. A chemical is harmful to human health only if it is absorbed into the body. Assuming complete bioavailability does not consider the fact that it is common for a fraction of the chemical taken into the body is excreted rather than being absorbed into the body. The bioavailability of a contaminant is dependent on many factors, such as the state or form of the contaminant and if the actual size of the contaminant particle would permit incidental ingestion. These issues must be considered when evaluating the appropriateness of assuming total bioavailability of a contaminant.

Finally, conservatism is inherent in the risk estimates. The USEPA recommended level of noncarcinogenic risk is less than or equal to 1. This level of risk represents a "no effect" level (calculated to incorporate appropriate safety factors), which is a dose at which no adverse health effects are expected. Exceeding this "no effect" level does not indicate a risk, only that the potential for a risk may exist. This potential increases as the hazard index exceeds 1, which means that the potential for risk is greater when a hazard index is at 10 than when it is at 3. When assessing carcinogenic risk, the USEPA recommended range of risk is 10^{-4} to 10^{-6}. This range represents the upper confidence limit, whereas the lower bound estimate of excess lifetime cancer risk is zero.

At Parcel 463, the estimated risk for the child (1 - 6 years) resident exceeds USEPA's recommended level, with iron as a risk driver for both populations. The maximum concentration of iron which was used in the evaluation was 118,000 mg/kg. All other iron concentrations at the site were identified at approximately 26,000 mg/kg. These data indicate that exposure to iron under realistic conditions at the site would be at a concentration consistent with 26,000 mg/kg. Therefore, although the estimated risk at the site exceeds USEPA's recommended level, considering the factors mentioned above, it is not expected that exposure to contaminants through these pathways would pose an increased risk to residential or commercial/industrial populations.

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5.2 Ecological

An ecological assessment of the site shows that nickel is present in sediment above background levels at concentrations which slightly exceed NOAA ER-M values. Additionally, aluminum, barium, beryllium, cobalt, iron, manganese, and vanadium were all detected in the site sediment at concentrations above background. The evaluation of surface water at the site does not indicate increased risk to aquatic life.

6.0 References

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Gilbert Tank Farm - Parcel 463

Table 1. Quantitative Risk Assessment - Noncarcinogenic

Residential Use - Incidental Ingestion/Soil

Chemical	RfD	Soil [ ] Max (mg/kg)	ADD Adult Resident	HQ Adult Resident	ADD Youth Resident (6 - 17 years)	HQ Youth Resident (6 - 17 years)	ADD Child Resident (1 - 6 years)	HQ Child Resident (1 - 6 years)
Aluminum	1	16100	2E-02	2E-02	4E-02	4E-02	2E-01	2E-01
Antimony	0.0004	38.3	5E-05	1E-01	9E-05	2E-01	5E-04	1E+00
Arsenic	0.0003	15.7	2E-05	7E-02	4E-05	1E-01	2E-04	6E-01
Beryllium	0.005	0.5	7E-07	1E-04	1E-06	2E-04	6E-06	1E-03
Cadmium	0.0005	6.9	9E-06	2E-02	2E-05	3E-02	8E-05	2E-01
Chromium	0.005	39.6	5E-05	1E-02	9E-05	2E-02	5E-04	9E-02
Iron	0.3	118000	2E-01	5E-01	3E-01	9E-01	1E+00	5E+00
Manganese	0.14	1870	3E-03	2E-02	4E-03	3E-02	2E-02	2E-01
Acenaphthene	0.06	0.3	4E-07	7E-06	7E-07	1E-05	4E-06	6E-05
Acenaphthylene*	0.03	0.16	2E-07	7E-06	4E-07	1E-05	2E-06	6E-05
Anthracene	0.3	0.92	1E-06	4E-06	2E-06	7E-06	1E-05	4E-05
Benzo[g,h,i]perylene*	0.03	1.6	2E-06	7E-05	4E-06	1E-04	2E-05	6E-04
Fluoranthene	0.04	9.7	1E-05	3E-04	2E-05	6E-04	1E-04	3E-03
Fluorene	0.04	0.48	7E-07	2E-05	1E-06	3E-05	6E-06	1E-04
2-Methylnaphthalene**	0.04	0.56	8E-07	2E-05	1E-06	3E-05	7E-06	2E-04
Naphthalene	0.04	0.16	2E-07	5E-06	4E-07	1E-05	2E-06	5E-05
Phenanthrene*	0.03	7.3	1E-05	3E-04	2E-05	6E-04	9E-05	3E-03
Pyrene	0.03	10	1E-05	5E-04	2E-05	8E-04	1E-04	4E-03
			SUM-->	0.8	SUM-->	1	SUM-->	7

ADD = Average Daily Dose
HQ = Hazard Quotient

* = Toxicity Data for Pyrene, a Structurally Similar Analogue, Were Used
** = Toxicity Data for Naphthalene, a Structurally Similar Analogue, Were Used
Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

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Gilbert Tank Farm - Parcel 463

Table 2. Quantitative Risk Assessment - Carcinogenic

Residential Use - Incidental Ingestion/Soil

Chemical	q1*	Soil [] Max (mg/kg)	LADD Adult Resident	CR Adult Resident	LADD Youth Resident (6 - 17 years)	CR Youth Resident (6 - 17 years)	LADD Child Resident (1 - 6 years)	CR Child Resident (1 - 6 years)
Arsenic	1.5	15.7	9E-06	1E-05	6E-06	1E-05	2E-05	2E-05
Beryllium	4.3	0.5	3E-07	1E-06	2E-07	9E-07	5E-07	2E-06
PAHs	7.3	5.6	3E-06	2E-05	2E-06	2E-05	6E-06	4E-05
Carbazole	0.02	0.43	3E-07	5E-09	2E-07	4E-09	4E-07	9E-09
			SUM-->	4E-05	**SUM-->**	3E-05	**SUM-->**	7E-05

LADD = Lifetime Average Daily Dose
CR = Excess Lifetime Cancer Risk

Table 3. Quantitative Risk Assessment - Noncarcinogenic

Residential Use - Ingestion/Surface Water

Chemical	RfD	Surface Water [] Max (mg/l)	ADD Adult Resident	HQ Adult Resident	ADD Youth Resident (6 - 17 years)	HQ Youth Resident (6 - 17 years)	ADD Child Resident (1 - 6 years)	HQ Child Resident (1 - 6 years)
Iron	0.3	1.89	5E-02	2E-01	5E-02	2E-01	1E-01	4E-01
Manganese	0.14	0.135	4E-03	3E-02	3E-03	2E-02	8E-03	6E-02
			SUM-->	0.2	**SUM-->**	0.2	**SUM-->**	0.4

ADD = Average Daily Dose
HQ = Hazard Quotient
Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

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Gilbert Tank Farm - Parcel 463

Table 4. Quantitative Risk Assessment - Noncarcinogenic

Residential Use - Incidental Ingestion/Sediment

Chemical	RfD	Sediment [] Max (mg/kg)	ADD Adult Resident	HQ Adult Resident	ADD Youth Resident (6 - 17 years)	HQ Youth Resident (6 - 17 years)	ADD Child Resident (1 - 6 years)	HQ Child Resident (1 - 6 years)
Aluminum	1	11800	1E-03	1E-03	3E-03	3E-03	2E-02	2E-02
Arsenic	0.0003	6.6	7E-07	2E-03	2E-06	6E-03	9E-06	3E-02
Beryllium	0.005	1.7	2E-07	3E-05	5E-07	9E-05	2E-06	5E-04
Iron	0.3	26100	3E-03	9E-03	7E-03	2E-02	3E-02	1E-01
Manganese	0.14	1730	2E-04	1E-03	5E-04	3E-03	2E-03	2E-02
Fluoranthene	0.04	0.16	2E-08	4E-07	4E-08	1E-06	2E-07	5E-06
Pyrene	0.03	0.16	2E-08	5E-07	4E-08	1E-06	2E-07	7E-06
			SUM-->	0.01	SUM-->	0.04	SUM-->	0.2

ADD = Average Daily Dose
HQ = Hazard Quotient

Table 5. Quantitative Risk Assessment - Carcinogenic

Residential Use - Incidental Ingestion/Sediment

Chemical	q1*	Sediment [] Max (mg/kg)	LADD Adult Resident	CR Adult Resident	LADD Youth Resident (6 - 17 years)	CR Youth Resident (6 - 17 years)	LADD Child Resident (1 - 6 years)	CR Child Resident (1 - 6 years)
Arsenic	1.5	6.6	3E-07	4E-07	3E-07	5E-07	8E-07	1E-06
Beryllium	4.3	1.7	7E-08	3E-07	8E-08	3E-07	2E-07	8E-07
PAHs	7.3	0.15	7E-09	5E-08	7E-09	5E-08	2E-08	1E-07
			SUM-->	8E-07	SUM-->	8E-07	SUM-->	2E-06

LADD = Lifetime Average Daily Dose
CR = Excess Lifetime Cancer Risk
Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1,
or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

ORIGINAL (Red)

Gilbert Tank Farm - Parcel 463

Table 6. Quantitative Risk Assessment - Noncarcinogenic

Commercial/Industrial Use - Incidental Ingestion/Soil

Chemical	RfD	Soil [] Max (mg/kg)	ADD Adult Worker	HQ Adult Worker	ADD Youth Trespasser (6 - 17 years)	HQ Youth Trespasser (6 - 17 years)	ADD Child Trespasser (1 - 6 years)	HQ Child Trespasser (1 - 6 years)
Aluminum	1	16100	8E-03	8E-03	1E-02	1E-02	7E-02	7E-02
Antimony	0.0004	38.3	2E-05	5E-02	3E-05	9E-02	2E-04	4E-01
Arsenic	0.0003	15.7	8E-06	3E-02	1E-05	5E-02	7E-05	2E-01
Beryllium	0.005	0.5	2E-07	5E-05	5E-07	9E-05	2E-06	5E-04
Cadmium	0.0005	6.9	3E-06	7E-03	6E-06	1E-02	3E-05	6E-02
Chromium	0.005	39.6	2E-05	4E-03	4E-05	7E-03	2E-04	4E-02
Iron	0.3	118000	6E-02	2E-01	1E-01	4E-01	5E-01	2E+00
Manganese	0.14	1870	9E-04	7E-03	2E-03	1E-02	8E-03	6E-02
Acenaphthene	0.06	0.3	1E-07	2E-06	3E-07	5E-06	1E-06	2E-05
Acenaphthylene*	0.03	0.16	8E-08	3E-06	1E-07	5E-06	7E-07	2E-05
Anthracene	0.3	0.92	5E-07	2E-06	8E-07	3E-06	4E-06	1E-05
Benzo[g,h,i]perylene*	0.03	1.6	8E-07	3E-05	1E-06	5E-05	7E-06	2E-04
Fluoranthene	0.04	9.7	5E-06	1E-04	9E-06	2E-04	4E-05	1E-03
Fluorene	0.04	0.48	2E-07	6E-06	4E-07	1E-05	2E-06	5E-05
2-Methylnaphthalene**	0.04	0.56	3E-07	7E-06	5E-07	1E-05	3E-06	6E-05
Naphthalene	0.04	0.16	8E-08	2E-06	1E-07	4E-06	7E-07	2E-05
Phenanthrene*	0.03	7.3	4E-06	1E-04	7E-06	2E-04	3E-05	1E-03
Pyrene	0.03	10	5E-06	2E-04	9E-06	3E-04	5E-05	2E-03
			SUM-->	0.3	**SUM-->**	0.5	**SUM-->**	3

ADD = Average Daily Dose
HQ = Hazard Quotient

* = Toxicity Data for Pyrene, a Structurally Similar Analogue, Were Used
** = Toxicity Data for Naphthalene, a Structurally Similar Analogue, Were Used
Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

ORIGINAL (Red)

Gilbert Tank Farm - Parcel 463

Table 7. Quantitative Risk Assessment - Carcinogenic

Commercial/Industrial Use - Incidental Ingestion/Soil

Chemical	q1*	Soil [ ] Max (mg/kg)	LADD Adult Worker	CR Adult Worker	LADD Youth Trespasser (6 - 17 years)	CR Youth Trespasser (6 - 17 years)	LADD Child Trespasser (1 - 6 years)	CR Child Trespasser (1 - 6 years)
Arsenic	1.5	15.7	8E-06	1E-05	1E-05	2E-05	6.1E-06	9.1E-06
Beryllium	4.3	0.5	2E-07	1E-06	5E-07	2E-06	1.9E-07	8.3E-07
PAHs	7.3	5.6	3E-06	2E-05	5E-06	4E-05	2.2E-06	1.6E-05
Carbazole	0.02	0.43	2E-07	4E-09	4E-07	8E-09	1.7E-07	3.3E-09
			SUM-->	3E-05	**SUM-->**	6E-05	**SUM-->**	3E-05

LADD = Lifetime Average Daily Dose
CR = Excess Lifetime Cancer Risk

Table 8. Quantitative Risk Assessment - Noncarcinogenic

Commercial/Industrial Use - Ingestion/Surface Water

Chemical	RfD	Surface Water [ ] Max (mg/l)	ADD Adult Worker	HQ Adult Worker	ADD Youth Trespasser (6 - 17 years)	HQ Youth Trespasser (6 - 17 years)	ADD Child Trespasser (1 - 6 years)	HQ Child Trespasser (1 - 6 years)
Iron	0.3	1.89	3E-02	9E-02	NA		NA	
Manganese	0.14	0.135	2E-03	1E-02	NA		NA	
			SUM-->	0.1	**SUM-->**		**SUM-->**	

ADD = Average Daily Dose
HQ = Hazard Quotient
NA = Not Applicable. Incidental Ingestion of Surface Water by the Youth and Child Trespasser is not quantitatively estimated; please see text for further details.
Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

ORIGINAL (Red)

Gilbert Tank Farm - Parcel 463

Table 9. Quantitative Risk Assessment - Noncarcinogenic

Commercial/Industrial Use - Incidental Ingestion/Sediment

Chemical	RfD	Sediment [] Max (mg/kg)	ADD Adult Worker	HQ Adult Worker	ADD Youth Trespasser (6 - 17 years)	HQ Youth Trespasser (6 - 17 years)	ADD Child Trespasser (1 - 6 years)	HQ Child Trespasser (1 - 6 years)
Aluminum	1	11800	1E-03	1E-03	3E-03	3E-03	2E-02	2E-02
Arsenic	0.0003	6.6	7E-07	2E-03	2E-06	6E-03	9E-06	3E-02
Beryllium	0.005	1.7	2E-07	3E-05	5E-07	9E-05	2E-06	5E-04
Iron	0.3	26100	3E-03	9E-03	7E-03	2E-02	3E-02	1E-01
Manganese	0.14	1730	2E-04	1E-03	5E-04	3E-03	2E-03	2E-02
Fluoranthene	0.04	0.16	2E-08	4E-07	4E-08	1E-06	2E-07	5E-06
Pyrene	0.03	0.16	2E-08	5E-07	4E-08	1E-06	2E-07	7E-06
			SUM-->	0.01	**SUM-->**	0.04	**SUM-->**	0.2

ADD = Average Daily Dose
HQ = Hazard Quotient

Table 10. Quantitative Risk Assessment - Carcinogenic

Commercial/Industrial Use - Incidental Ingestion/Sediment

Chemical	q1*	Sediment [] Max (mg/kg)	LADD Adult Worker	CR Adult Worker	LADD Youth Trespasser (6 - 17 years)	CR Youth Trespasser (6 - 17 years)	LADD Child Trespasser (1 - 6 years)	CR Child Trespasser (1 - 6 years)
Arsenic	1.5	6.6	2E-07	4E-07	3E-07	5E-07	8E-07	1E-06
Beryllium	4.3	1.7	6E-08	3E-07	8E-08	3E-07	2E-07	8E-07
PAHs	7.3	0.15	5E-09	4E-08	7E-09	5E-08	2E-08	1E-07
			SUM-->	7E-07	**SUM-->**	8E-07	**SUM-->**	2E-06

LADD = Lifetime Average Daily Dose
CR = Excess Lifetime Cancer Risk
Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

ORIGINAL (Red)

Gilbert Tank Farm - Parcel 463

Table 11. Quantitative Risk Assessment - Noncarcinogenic

Background

Residential Use - Incidental Ingestion/Soil

Chemical	RfD	Soil [] Max (mg/kg)	ADD Adult Resident	HQ Adult Resident	ADD Youth Resident (6 - 17 years)	HQ Youth Resident (6 - 17 years)	ADD Child Resident (1 - 6 years)	HQ Child Resident (1 - 6 years)
Aluminum	1	8870	1E-02	1E-02	2E-02	2E-02	1E-01	1E-01
Arsenic	0.0003	4	5E-06	2E-02	1E-05	3E-02	5E-05	2E-01
Beryllium	0.005	0.65	9E-07	2E-04	2E-06	3E-04	8E-06	2E-03
Iron	0.3	15200	2E-02	7E-02	4E-02	1E-01	2E-01	6E-01
Manganese	0.14	348	5E-04	3E-03	8E-04	6E-03	4E-03	3E-02
Benzo[g,h,i]perylene*	0.03	0.13	2E-07	6E-06	3E-07	1E-05	2E-06	5E-05
Fluoranthrene	0.04	0.2	3E-07	7E-06	5E-07	1E-05	2E-06	6E-05
Phenanthrene*	0.03	0.071	1E-07	3E-06	2E-07	6E-06	9E-07	3E-05
Pyrene	0.03	0.19	3E-07	9E-06	5E-07	2E-05	2E-06	8E-05
			SUM-->	0.1	**SUM-->**	0.2	**SUM-->**	0.9

ADD = Average Daily Dose
HQ = Hazard Quotient

* = Toxicity Data for Pyrene, a Structurally Similar Analogue, Were Used

Table 12. Quantitative Risk Assessment - Carcinogenic

Background

Residential Use - Incidental Ingestion/Soil

Chemical	q1*	Soil [] Max (mg/kg)	LADD Adult Resident	CR Adult Resident	LADD Youth Resident (6 - 17 years)	CR Youth Resident (6 - 17 years)	LADD Child Resident (1 - 6 years)	CR Child Resident (1 - 6 years)
Arsenic	1.5	4	2E-06	4E-06	2E-06	2E-06	4E-06	6E-06
Beryllium	4.3	0.65	4E-07	2E-06	3E-07	1E-06	7E-07	3E-06
PAHs	7.3	0.3	2E-07	1E-06	1E-07	9E-07	3E-07	2E-06
			SUM-->	6E-06	**SUM-->**	5E-06	**SUM-->**	1E-05

LADD = Lifetime Average Daily Dose
CR = Excess Lifetime Cancer Risk
Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

ORIGINAL (Red)

Table 13. Quantitative Risk Assessment - Noncarcinogenic
Background
Residential Use - Ingestion/Surface Water

Chemical	RfD	Surface Water [] Max (mg/l)	ADD Adult Resident	HQ Adult Resident	ADD Youth Resident (6 - 17 years)	HQ Youth Resident (6 - 17 years)	ADD Child Resident (1 - 6 years)	HQ Child Resident (1 - 6 years)
Iron	0.3	1.97	5E-02	2E-01	5E-02	2E-01	1E-01	4E-01
Manganese	0.14	0.143	4E-03	3E-02	3E-03	2E-02	9E-03	6E-02
			SUM-->	0.2	**SUM-->**	0.2	**SUM-->**	0.5

ADD = Average Daily Dose

Gilbert Tank Farm - Parcel 463

Table 14. Quantitative Risk Assessment - Noncarcinogenic
Background
Residential Use - Incidental Ingestion/Sediment

Chemical	RfD	Sediment [] Max (mg/kg)	ADD Adult Resident	HQ Adult Resident	ADD Youth Resident (6 - 17 years)	HQ Youth Resident (6 - 17 years)	ADD Child Resident (1 - 6 years)	HQ Child Resident (1 - 6 years)
Aluminum	1	1210	1E-04	1E-04	3E-04	3E-04	2E-03	2E-03
Arsenic	0.0003	2.6	3E-07	9E-04	7E-07	2E-03	3E-06	1E-02
Beryllium	0.005	1.1	1E-07	2E-05	3E-07	6E-05	1E-06	3E-04
Iron	0.3	22000	2E-03	7E-03	6E-03	2E-02	3E-02	1E-01
Manganese	0.14	851	9E-05	6E-04	2E-04	2E-03	1E-03	8E-03
Fluoranthene	0.04	0.15	2E-08	4E-07	4E-08	1E-06	2E-07	5E-06
Pyrene	0.03	0.13	1E-08	4E-07	3E-08	1E-06	2E-07	6E-06
			SUM-->	0.009	**SUM-->**	0.02	**SUM-->**	0.1

ADD = Average Daily Dose
HQ = Hazard Quotient
Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

Table 15. Quantitative Risk Assessment - Carcinogenic

Background

Residential Use - Incidental Ingestion/Sediment

Chemical	q1*	Sediment [ ] Max (mg/kg)	LADD Adult Resident	CR Adult Resident	LADD Youth Resident (6 - 17 years)	CR Youth Resident (6 - 17 years)	LADD Child Resident (1 - 6 years)	CR Child Resident (1 - 6 years)
Arsenic	1.5	2.3	1E-07	2E-07	1E-07	2E-07	3E-07	4E-07
Beryllium	4.3	0.15	7E-09	3E-08	7E-09	3E-08	2E-08	7E-08
PAHs	7.3	0.15	7E-09	5E-08	7E-09	5E-08	2E-08	1E-07
			SUM-->	2E-07	**SUM-->**	2E-07	**SUM-->**	6E-07

LADD = Lifetime Average Daily Dose
CR = Excess Lifetime Cancer Risk
Shading indicates that population exceeds the USEPA recommended hazard Index of less than or equal to 1,
or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

ORIGINAL (Red)

Table 16. PAH Relative Potency Concentrations
Parcel 463 - Soil

Chemical	Soil Concentration (mg/kg)	Relative Potency Factor	Relative Concentration (mg/kg)
Benz[a]anthracene	4.2	0.1	0.42
Benzo[b]fluoranthene	5.5	0.1	0.55
Benzo[k]fluoranthene	5.5	0.01	0.055
Benzo[a]pyrene	4	1	4
Chrysene	4.6	0.001	0.0046
Dibenz[a,h]anthracene	0.41	1	0.41
Indeno[1,2,3-cd]pyrene	1.6	0.1	0.16
		SUM-->	5.6

Table 17. PAH Relative Potency Concentrations
Parcel 463 - Sediment

Chemical	Soil Concentration (mg/kg)	Relative Potency Factor	Relative Concentration (mg/kg)
Benz[a]anthracene	0.1	0.1	0.01
Benzo[b]fluoranthene	0.15	0.1	0.015
Benzo[k]fluoranthene	0.15	0.01	0.0015
Benzo[a]pyrene	0.12	1	0.12
Chrysene	0.12	0.001	0.00012
		SUM-->	0.15

Table 18. PAH Relative Potency Concentrations
Background - Soil

Chemical	Soil Concentration (mg/kg)	Relative Potency Factor	Relative Concentration (mg/kg)
Benz[a]anthracene	0.16	0.1	0.016
Benzo[b]fluoranthene	0.34	0.1	0.034
Benzo[k]fluoranthene	0.27	0.01	0.0027
Benzo[a]pyrene	0.19	1	0.19
Chrysene	0.17	0.001	0.00017
Dibenz[a,h]anthracene	0.045	1	0.045
Indeno[1,2,3-cd]pyrene	0.1	0.1	0.01
		SUM-->	0.30

ORIGINAL (Red)

Table 19. PAH Relative Potency Concentrations

Background - Sediment

Chemical	Soil Concentration (mg/kg)	Relative Potency Factor	Relative Concentration (mg/kg)
Benz[a]anthracene	0.1	0.1	0.01
Benzo[b]fluoranthene	0.15	0.1	0.015
Benzo[k]fluoranthene	0.15	0.01	0.0015
Benzo[a]pyrene	0.12	1	0.12
Chrysene	0.12	0.001	0.00012
		SUM-->	0.15

ORIGINAL (Red)

Table 20. Quantitative Risk Assessment

Residential Exposure Scenario - Noncarcinogenic Risk

Chemical	Soil	Surface Water	Sediment	Risk From Exposure to Contaminant in All Media
Adult Resident				
Aluminum	2E-02		1E-03	2E-02
Antimony	1E-01			1E-01
Arsenic	7E-02		2E-03	7E-02
Beryllium	1E-04		4E-05	2E-04
Cadmium	2E-02			2E-02
Chromium	1E-02			1E-02
Iron	5E-01	2E-01	9E-03	7E-01
Manganese	2E-02	3E-02	1E-03	5E-02
Acenaphthene	7E-06			7E-06
Acenaphthylene	7E-06			7E-06
Anthracene	4E-06			4E-06
Benzo[g,h,i]perylene	7E-05			7E-05
Fluoranthene	3E-04		4E-07	3E-04
Fluorene	2E-05			2E-05
2-Methylnaphthalene	2E-05			2E-05
Naphthalene	6E-06			6E-06
Phenanthrene	3E-04			3E-04
Pyrene	5E-04		5E-07	5E-04
Risk From Exposure to All Contaminants in a Medium	0.8	0.2	1	
Youth Resident				
Aluminum	4E-02		3E-03	4E-02
Antimony	2E-01			2E-01
Arsenic	1E-01		6E-03	1E-01
Beryllium	2E-04		9E-05	3E-04
Cadmium	3E-02			3E-02
Chromium	2E-02			2E-02
Iron	9E-01	2E-01	2E-02	1E+00
Manganese	3E-02	2E-02	3E-03	6E-02
Acenaphthene	1E-05			1E-05
Acenaphthylene	1E-05			1E-05
Anthracene	7E-06			7E-06
Benzo[g,h,i]perylene	1E-04			1E-04
Fluoranthrene	6E-05		1E-06	6E-05
Fluorene	3E-05			3E-05
2-Methylnaphthalene	3E-05			3E-05
Naphthalene	1E-05			1E-05
Phenanthrene	6E-04			6E-04
Pyrene	8E-04		1E-06	8E-04
Risk From Exposure to All Contaminants in a Medium	1	0.2	0.04	

Shading indicates that population exceeds the USEPA recommended Hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

ORIGINAL (Red)

Table 20 (Continued). Quantitative Risk Assessment

Residential Exposure Scenario - Noncarcinogenic Risk

Chemical	Soil	Surface Water	Sediment	Risk From Exposure to Contaminant in All Media
Child Resident				
Aluminum	2E-01		2E-02	2E-01
Antimony	1E+00			1E+00
Arsenic	6E-01		3E-02	7E-01
Beryllium	1E-03		5E-04	2E-03
Cadmium	2E-01			2E-01
Chromium	1E-01			1E-01
Iron	5E+00	4E-01	1E-01	5E+00
Manganese	2E-01	6E-02	2E-02	2E-01
Acenaphthene	6E-05			6E-05
Acenaphthylene	6E-05			6E-05
Anthracene	4E-05			4E-05
Benzo[g,h,i]perylene	6E-04			6E-04
Fluoranthene	3E-03		5E-06	3E-03
Fluorene	1E-03		7E-06	1E-03
2-Methylnaphthalene	2E-04			2E-04
Naphthalene	5E-05			5E-05
Phenanthrene	3E-03			3E-03
Pyrene	4E-03			4E-03
Risk From Exposure to All Contaminants in a Medium	7	0.4	0.2	
Residential Exposure Scenario - Carcinogenic Risk				
Adult Resident				
Arsenic	1E-05		4E-07	1E-05
Beryllium	1E-06		3E-07	1E-06
Carcinogenic PAHs	2E-05		5E-08	2E-05
Carbazole	5E-09			5E-09
Risk From Exposure to All Contaminants in a Medium	3E-05		8E-07	
Youth Resident				
Arsenic	1E-05		5E-07	1E-05
Beryllium	9E-07		3E-07	1E-06
Carcinogenic PAHs	2E-05		5E-08	2E-05
Carbazole	4E-09			4E-09
Risk From Exposure to All Contaminants in a Medium	3E-05		9E-07	

Shading indicates that population exceeds the USEPA recommended Hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

Table 20 (continued). Quantitative Risk Assessment

Residential Exposure Scenario - Carcinogenic Risk

Chemical	Soil	Surface Water	Sediment	Risk From Exposure to Contaminant in All Media
Child Resident				
Arsenic	2E-05		1E-06	2E-05
Beryllium	2E-06		8E-07	3E-06
Carcinogenic PAHs	4E-05		1E-07	4E-05
Carbazole	9E-09			9E-09
Risk From Exposure to All Contaminants in a Medium	4E-05		2E-06	
Commercial/Industrial Exposure Scenario - Noncarcinogenic Risk				
Adult Worker				
Aluminum	8E-03		1E-03	9E-03
Antimony	5E-02			5E-02
Arsenic	3E-02		2E-03	3E-02
Beryllium	5E-05		4E-05	8E-05
Cadmium	7E-03			7E-03
Chromium	4E-03			4E-03
Iron	2E-01	9E-02	9E-03	3E-01
Manganese	7E-03	1E-02	1E-03	2E-02
Acenaphthene	2E-06			2E-06
Acenaphthylene	3E-06			3E-06
Anthracene	2E-06			2E-06
Benzo[g,h,i]perylene	3E-05			3E-05
Fluoranthene	1E-04		4E-07	1E-04
Fluorene	7E-06			7E-06
2-Methylnaphthalene	7E-06			7E-06
Naphthalene	2E-06			2E-06
Phenanthrene	1E-04			1E-04
Pyrene	2E-04		5E-07	2E-04
Risk From Exposure to All Contaminants in a Medium	0.3	0.1	0.01	

Shading indicates that population exceeds the USEPA recommended Hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

ORIGINAL (Red)

Table 20 (continued). Quantitative Risk Assessment

Commercial/Industrial Exposure Scenario - Noncarcinogenic Risk

Chemical	Soil	Surface Water	Sediment	Risk From Exposure to Contaminant in All Media
Youth Trespasser				
Aluminum	2E-02		3E-03	2E-02
Antimony	9E-02			9E-02
Arsenic	5E-02		6E-03	5E-02
Beryllium	9E-05		9E-05	2E-04
Cadmium	1E-02			1E-02
Chromium	7E-03			7E-03
Iron	4E-01		2E-02	4E-01
Manganese	1E-02		3E-03	2E-02
Acenaphthene	5E-06			5E-06
Acenaphthylene	5E-06			5E-06
Anthracene	3E-06			3E-06
Benzo[g,h,i]perylene	5E-05			5E-05
Fluoranthene	2E-04		1E-06	2E-04
Fluorene	1E-05			1E-05
2-Methylnaphthalene	1E-05			1E-05
Naphthalene	4E-06			4E-06
Phenanthrene	2E-04			2E-04
Pyrene	3E-04		1E-06	3E-04
Risk From Exposure to All Contaminants in a Medium	0.5		0.04	

ORIGINAL (Red)

Table 20 (continued). Quantitative Risk Assessment

Commercial/Industrial Exposure Scenario - Noncarcinogenic Risk

Chemical	Soil	Surface Water	Sediment	Risk From Exposure to Contaminant in All Media
Child Trespasser				
Aluminum	7E-02		2E-02	9E-02
Antimony	4E-01			4E-01
Arsenic	2E-01		3E-02	3E-01
Beryllium	5E-04		5E-04	9E-04
Cadmium	6E-02			6E-02
Chromium	4E-02			4E-02
Iron	2E+00		1E-01	2E+00
Manganese	6E-02		2E-02	8E-02
Acenaphthene	2E-05			2E-05
Acenaphthylene	2E-05			2E-05
Anthracene	1E-05			1E-05
Benzo[g,h,i]perylene	2E-04			2E-04
Fluoranthene	1E-03		5E-06	1E-03
Fluorene	5E-05			5E-05
2-Methylnaphthalene	6E-05			6E-05
Naphthalene	2E-05			2E-05
Phenanthrene	1E-03			1E-03
Pyrene	2E-03		7E-06	2E-03
Risk From Exposure to All Contaminants in a Medium	3		0.2	

Commercial/Industrial Exposure Scenario - Carcinogenic Risk

Chemical	Soil	Surface Water	Sediment	Risk From Exposure to Contaminant in All Media
Adult Worker				
Arsenic	5E-06		4E-07	5E-06
Beryllium	6E-08		3E-07	4E-07
Carcinogenic PAHs	4E-07		4E-08	4E-07
Carbazole	1E-05			1E-05
Risk From Exposure to All Contaminants in a Medium	2E-05		7E-07	
Youth Trespasser				
Arsenic	1E-05		5E-07	1E-05
Beryllium	1E-07		3E-07	4E-07
Carcinogenic PAHs	7E-07		5E-08	8E-07
Carbazole	2E-05			2E-05
Risk From Exposure to All Contaminants in a Medium	3E-05		9E-07	

Shading indicates that population exceeds the USEPA recommended Hazard Index of less than or equal to 1, or recommended Excess Lifetime Cancer Risk of 1E-04 - 1E-06.

Table 20 (continued). Quantitative Risk Assessment

Commercial/Industrial Exposure Scenario - Carcinogenic Risk

Child Trespasser

Arsenic	9E-06		2E-06	1E-05
Beryllium	8E-07		8E-07	2E-06
Carcinogenic PAHs	2E-05		1E-07	2E-05
Carbazole	3E-09			3E-09
Risk From Exposure to All Contaminants in a Medium	3E-05		3E-06	

APPENDIX D - PICTURES